## REMARKS

By the present amendment, claims 1 to 9 and 18 to 27 are pending in the application. Claim 1 is the only independent claim.

**Claim Amendment**

The amended Cu content of 0.1 to 1.5% of claim 1 is based on the description on page 21, lines 19 - 29 of the specification as follows.

"(1) When 0.01 to 0.1 mass % Mo is added to a steel containing not less than 0.1 mass % Cu, the rate of progress of local corrosion is remarkably decreased to not more than 1/5 that of an ordinary steel.

(2) When more than 0.1 mass % Mo is added to a steel containing not less than 0.1 mass % Cu, the effect of Mo on suppressing the rate of progress of local corrosion decreases.

(3) In the case of a steel containing not less than 0.1 mass % Cu, the most suitable addition amount of Mo is in the range from 0.03 to 0.07 mass %."

**§103**

Claims 1 to 9 and 18 to 27 were rejected under 35 U.S.C. §103(a) as being unpatentable over Japan No. 2002-12940 to Kimura in view of U.S. Patent No. 3,733,195 to Nishi et al. or U.S. Patent No. 4,407,681 to Ina et al.

Claims 1 to 9 and 18 to 27 were rejected under 35 U.S.C. §103(a) as being unpatentable over U.S. Patent No. 4,407,681 to Ina et al. in view of U.S. Patent No. 3,733,195 to Nishi et al.

These rejections, as applied to the amended claims, are respectfully traversed.

**The Present Invention**

The present invention provides a crude oil tank, with the crude oil tank fabricated from a steel for a welded structure to be used for a crude oil tank. The steel exhibits excellent local corrosion resistance in the environment of the floor plate of a crude oil tank and a decreased rate of formation of a corrosion product containing solid sulfur in a gas phase at the reverse side of the upper deck plate of a crude oil tank.

The present inventors found that the concentration of rock salt brine, which varies in accordance with the oil field and the depth of an oil well from which the crude oil came, is as high as roughly 1 to 60 mass % in terms of an NaCl-reduced concentration. Further, the present inventors found that when a steel plate is exposed to such a high-concentration brine, or a high-concentration of an aqueous solution of halogen, the steel plate surface becomes uneven because of the sediment of corrosion products, sludge, which is caused by solid sulfur which precipitates as a result of a reaction of hydrogen sulfide and oxygen in a gas phase in a crude oil tank, with iron rust on the surface working as a catalyst, ash and the like.

The present invention targets to enhance corrosion resistance, or resistance to general corrosion and sludge formation, in the environment in question by not adding Cr, but by adding Cu of more than 0.1% and Mo in combination by respectively defined amounts of Cu and Mo and limiting the amount of P and S, which are impurity elements, on the basis of the chemical composition of a welded structure, as shown in Fig. 1 of the specification. More specifically, it is a new discovery that a small amount of addition of Mo remarkably decreases the local corrosion rate in case of Fe-Cu-Mo steel as shown in Fig. 1. Regarding the effect of W, it is also a new discovery that a small amount of W is effective to decrease the local corrosion rate the same as the Mo addition.

**Patentability**

**Japan No. 2002-12940 (the " '940 patent")**

The technology disclosed in the '940 patent provides a corrosion resistive steel for a tank loading oil, having good corrosion resistance and capable of improving weldability, where the steel contains: $\leq$ 0.016%C, $\leq$1.5%Si, $\leq$3.0%Mn, $\leq$0.035%P, $\leq$0.01%S, and further containing one or more of 0.1 - 1.4%Cu, 0.2 - 4%Cr and 0.05 - 0.7%Ni, and the balance being Fe and unavoidabe impurities.

**Primer coating**

The '940 patent clearly discloses that it is difficult to obtain a required corrosion resistance without a coating (as a naked state of the steel) even if the steel contains the specific alloying elements for improving corrosion resistance in an environment of acid dew point corrosion, as disclosed in [0011]. Therefore, the '940 patent definitely applies a coating to the steel. However, there is a problem of damage to the coated portion and rusting. Therefore, the '940 patent overcomes this problem by means of applying primer coating beneath the coating for preventing rusting. This means that the '940 patent targets to apply primer coating for preventing rusting in an environment of acid dew point corrosion, without the addition of the specific alloying elements to the steel.

This technical idea in the '940 patent is quite different from that of the present invention.

**Steel composition**

An important technical feature of the '940 patent is the addition of Cr of more than 0.2% and Cu of more than 0.1% for minimizing the rust area ratio in the primer coated state in the corrosion test in dew atmosphere, as mentioned in [0058] and Fig. 2. In addition, Mo is an optional element contained up to 0.5%. Regarding Mo, the '940 patent clearly

mentions in [0027] that although Mo is a harmful element for corrosion resistance in the aimed environment, Mo can be used in a limited amount to increase strength. If the Mo content exceeds 0.5%, corrosion resistance under the coating deteriorates. Therefore, Mo must be added below 0.5%.

This means that there is no disclosure or suggestion about a characteristic feature of the present invention of lowering local corrosion rate by the addition of Mo in Fe-Cu-Mo steel as shown in Fig. 1 of the specification. The present invention is a quite opposite technical idea which uses as a naked state steel. The '940 patent denies to use a steel as a naked state. Further, the '940 patent denies to use a steel as a naked state. Further, the '940 patent does not disclose or suggest to add W which lowers local corrosion rate with the addition of Mo in Fe-Cu-Mo steel. In addition, the '940 patent contains Cr of more than 0.2%. On the other hand, the present invention contains Cr of less than 0.1%, and the Cr addition is avoided.

**U.S. Patent No. 3,733,195 (the " '195 patent")**

The technology disclosed in USP 3,733,195 ( '195 patent) relates to sea-water corrosion resistant steels having improved weldability, where the steel consists of: C: 0.001 - 0.30%, Si: 0.1 - 2.0%, Mn: 0.3 - 2.0%, Cr: 0.01 - 0.50%, Cu: 0.1 - 0.29%, P: 0.0001 - 0.40%, and optionally contains one or more of Ti, Zr, Nb, V, Mo, W and Ni of 0.01 - 0.50%. Although the '195 patent mentions in column 2, lines 63-72 that such as parts of ship hulls and oil pipe lines which are exposed alternately or simultaneously to oil, sea-water and plain water, it is only tested in sea-water, which is quite different from the concentration of rock salt brine, which varies in accordance with the oil field and the depth of an oil well from which the crude oil came, and is as high as roughly 1 to 60 mass % in terms of an NaCl-reduced concentration in the environment, with pH of less than 2, of the floor plate of a crude

oil tank and a decreased rate of formation of a corrosion product containing solid sulfur in a gas phase at the reverse side of the upper deck plate of a crude oil tank.

This characteristic feature of the present invention is not disclosed or suggested in the '195 patent because of 1969's old technology. It is impossible to apply the 1969's old technology to the most recent technical problems.

Regarding the steel composition (especially Mo and W), the '195 patent discloses to contain Mo or W: 0.1 - 1.50% as an optional element. However, the '195 patent does not disclose or suggest a characteristic feature of the present invention of lowering local corrosion rate by the addition of Mo in Fe-Cu-Mo steel as shown in Fig. 1. Further, as shown in Fig. 1 of the '195 patent, Cr is an indispensable element and is contained at 0.01 - 0.50%, preferably Cr of more than 0.100% to increase corrosion resistance.

However, the present invention contains Cr of less than 0.1%, which is a different amount of Cr from the '195 patent. Therefore, it is impossible to conceive the characteristic feature, i.e., lowering local corrosion rate by the addition of Mo (or W) in Fe-Cu-Mo steel of the present invention from the '195 patent.

**U.S. Patent No. 4,407,681 (the " '681 patent")**

The technology disclosed in USP 4,407,681 ( '681 patent) relates to a high tensile steel having a high yield strength of 60 kg/mm$^2$ or more and excellent resistance to sulfide corrosive cracking and corrosion, and which contains C: 0.05 - 0.50%, Si: 0.1 - 1.0%, Mn: 0.1 - 2.0%, Co: 0.05 - 1.50%, the balance being Fe and unavoidable impurities, which is produced by hot-rolling, cold-rolling, rapidly heating for austenizing, quenching the austenized steel and finally tempering the quenched steel at a temperature not higher than $Ac_1$ point of the steel. As mentioned in the specification (column 2, lines 11 - 15), the '681 patent aims to provide a high tensile strength steel having a high yield strength of 60 kg/mm$^2$ or more and exhibiting excellent resistance to sulfide corrosion cracking and corrosion. The

environment used for this high strength steel fabricated in various pipes, machines and tanks is only an oil containing hydro-sulfide ($H_2S$), as mentioned in column 1, lines 16 - 23. The corrosion test carried out in the '681 patent is 0.5% of acetic acid, 5% of sodium chloride and 3000 ppm of hydrogen sulfide and having a pH of 3.0 to 3.5, as disclosed in column 7, line 21 to column 8, line 3.

On the other hand, the environment used in the present inventive steel is a general oil tank including hydro-sulfide ($H_2S$) in an oil, which is a different environment from that of the '681 patent. As disclosed in the specification of the present invention, an environment used in the present inventive steel is not only oil containing hydro-sulfide ($H_2S$), but also a pH of 0.5 (1 vol % HC1 + 10 mass % NaC1) and pH of 0.2 (vol % HC1 + 20 mass % NaC1). Therefore, there are differences in the points of $H_2SO_4$ and HC1, pH 3.0 - 3.5 and pH 0.2 - 0.5.

Regarding the steel compositions, an important feature of the '681 patent is to contain Cr: 0.2 - 0.99% preventing lowering an average corrosion rate. The addition of Co: 0.05 - 1.5%, Mo: 0.05 - 1.0% may be added as an optional element to ensure enhancing hardenability and higher strength. The upper limit of the Mo: 1.0% addition is to exhibit and enhance brittleness and deteriorated hot-workability and weldability, as disclosed in column 4, lines 54 - 65. However, the present invention limits the Cr addition to less than 0.1%, which is different from the '681 patent.

The '681 patent does not disclose or suggest the characteristic feature, i.e., lowering local corrosion rate by the addition of Mo (or W) in Fe-Cu-Mo steel of the present invention. Such a feature is discovered only by the actual experiments. It is submitted that it is impossible to conceive the present inventive features based on the teaching of the '681 patent in addition to the specific test as mentioned above. Further, the '681 patent does not disclose or suggest the W addition. Therefore, it is submitted that a person skilled in the art

cannot conceive the characteristic feature, i.e., lowering local corrosion rate by the addition of Mo (or W) in Fe-Cu-Mo steel according to the present invention based on the teaching of the '681 patent.

As mentioned above, both of the references of the '195 patent and '681 patent do not disclose or suggest the characteristic feature, i.e., lowering local corrosion rate by the addition of Mo (or W) in Fe-Cu-Mo steel according to the present invention even if both references are combined.

It is therefore submitted that independent claim 1, and all claims dependent thereon, are patentable over Japan No. 2002-12940, U.S. Patent No. 3,733,195 and/or U.S. Patent No. 4,407,681.

## CONCLUSION

It is submitted that in view of the present amendment and foregoing remarks, the application is now in condition for allowance. It is therefore respectfully requested that the application, as amended, be allowed and passed for issue.

Respectfully submitted,

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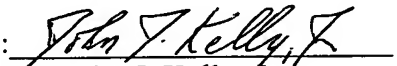
By: 
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